

Centre No.						Surname	Initial(s)	
Candidate No.						Signature		

Paper Reference(s)

4335/2H

London Examinations IGCSE

Chemistry

Paper 2H

Higher Tier

Wednesday 16 May 2007 – Morning

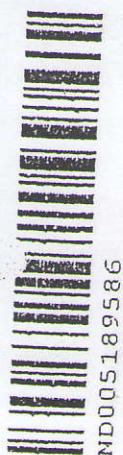
Time: 2 hours

Examiner's use only

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Team Leader's use only

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Materials required for examination

Nil

Items included with question papers

Nil

Question Number	Leave Blank
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Instructions to Candidates

In the boxes above, write your centre number and candidate number, your surname, initial(s) and signature.

The paper reference is shown at the top of this page. Check that you have the correct question paper.

Answer ALL the questions in the spaces provided in this question paper.

Show all the steps in any calculations and state the units.

Calculators may be used.

Information for Candidates

The total mark for this paper is 120. The marks for parts of questions are shown in round brackets: e.g. (2).

There are 24 pages in this question paper. All blank pages are indicated.

A Periodic Table is given on page 2.

Advice to Candidates

Write your answers neatly and in good English.

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THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group

1	H	1
	Hydrogen	

4	He	2
	Helium	

7	Li	3	9	Be	4
	Lithium			Beryllium	
23	Na	11	24	Mg	12
	Sodium			Magnesium	
39	K	19	40	Ca	20
	Potassium			Calcium	
86	Rb	37	88	Sr	38
	Rubidium			Strontium	
133	Cs	55	137	Ba	56
	Caesium			Barium	
223	Fr	87	226	Ra	88
	Francium			Radium	
			227	Ac	89
				Actinium	

45	Sc	21	48	Ti	22	51	V	23	52	Cr	24	55	Mn	25	56	Fe	26	59	Co	27	59	Ni	28	63.5	Cu	29	65	Zn	30
	Scandium			Titanium			Vanadium			Chromium			Manganese			Iron			Cobalt			Nickel			Copper			Zinc	
89	Y	39	91	Zr	40	93	Nb	41	96	Mo	42	99	Tc	43	101	Ru	44	103	Rh	45	106	Pd	46	108	Ag	47	112	Cd	48
	Yttrium			Zirconium			Niobium			Molybdenum			Technetium			Ruthenium			Rhodium			Palladium			Silver			Cadmium	
139	La	57	179	Hf	72	181	Ta	73	184	W	74	186	Re	75	190	Os	76	192	Ir	77	195	Pt	78	197	Au	79	201	Hg	80
	Lanthanum			Hafnium			Tantalum			Tungsten			Rhenium			Osmium			Iridium			Platinum			Gold			Mercury	

11	B	5	12	C	6	14	N	7	16	O	8	19	F	9	35.5	Cl	17	32	S	16	79	Se	34	80	Br	35	127	I	53	54	Xe	54
	Boron			Carbon			Nitrogen			Oxygen			Fluorine			Chlorine			Sulphur			Selenium			Bromine			Iodine			Xenon	
27	Al	13	28	Si	14	31	P	15	32	As	33	75	As	33	75	Se	34	79	Br	35	80	Kr	36	84	Kr	36	131	Xe	54	222	Rn	86
	Aluminium			Silicon			Phosphorus			Arsenic			Arsenic			Selenium			Bromine			Krypton			Krypton			Xenon			Radon	
70	Ga	31	73	Ge	32	75	As	33	79	Se	34	80	Br	35	127	I	53	210	Po	84	209	Bi	83	208	Pb	82	207	Tl	81	204	Pb	82
	Gallium			Germanium			Arsenic			Selenium			Bromine			Iodine			Polonium			Bismuth			Lead			Thallium			Lead	

Key

Relative atomic mass
Symbol
Name
Atomic number

SECTION A

1. Hydrogen peroxide decomposes into water and oxygen.

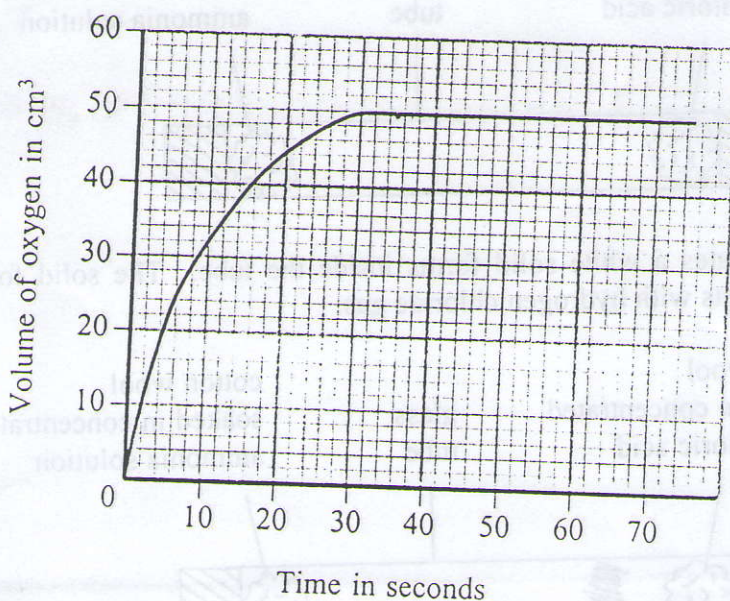


The reaction is very slow but becomes faster if manganese(IV) oxide is added. The manganese(IV) oxide does not get used up during the reaction.

(a) What is the role of the manganese(IV) oxide in this reaction?

(1)

(b) The graph shows how the volume of oxygen collected changed with time when 1 g of small lumps of manganese(IV) oxide were added to 10 cm³ of hydrogen peroxide.



Sketch on the axes above the results obtained when

(i) the experiment is repeated using 1 g of powdered manganese(IV) oxide. Label this sketch A.

(2)

(ii) the same volume of hydrogen peroxide is used but 5 cm^3 of water is added to it before the manganese(IV) oxide is added.
Label this sketch **B**.

(2)

(c) Describe a test for oxygen gas.

Test

Result

(2)

Q1

(Total 7 marks)



2. The decomposition of ammonium chloride is a reversible reaction.

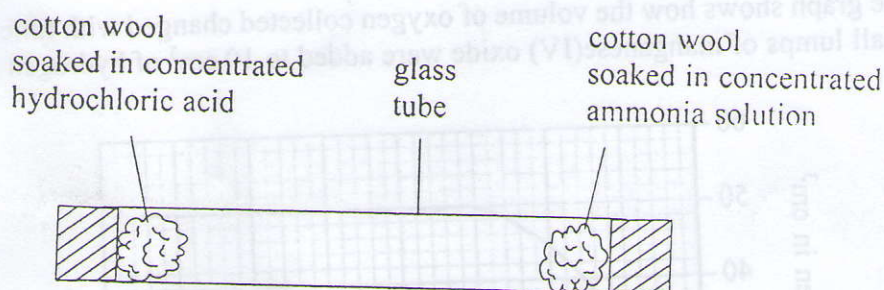


- (a) How is this reaction made to go in the **forward** direction?

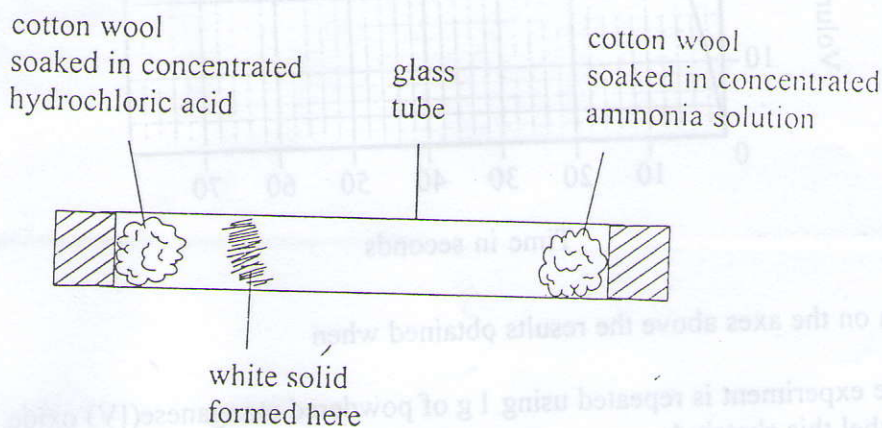
(1)

- (b) Concentrated hydrochloric acid gives off hydrogen chloride gas.
Concentrated ammonia solution gives off ammonia gas.

An experiment is set up.



After a few minutes a white solid forms inside the tube. The solid forms when ammonia gas reacts with hydrogen chloride gas.



- (i) Name the process by which the ammonia and hydrogen chloride particles move inside the tube.

(1)

- (ii) What is the white solid that forms inside the tube?

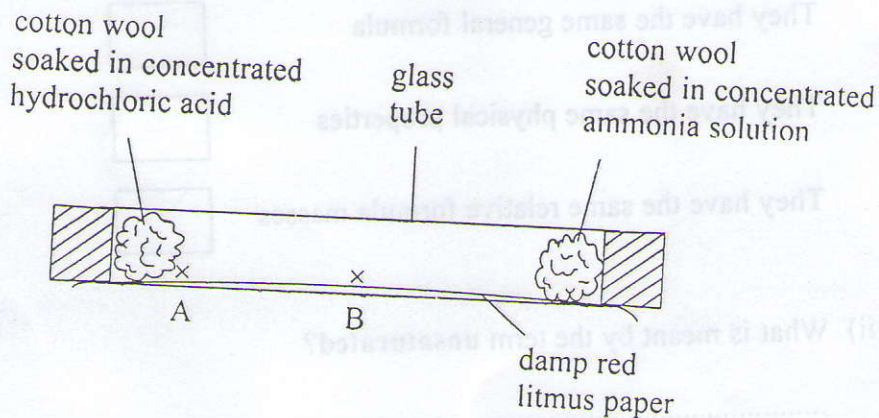
(1)

- (iii) What does the position of the white solid tell you about the relative speeds at which the ammonia and hydrogen chloride particles move?

.....
.....

(1)

- (iv) The experiment is repeated with a strip of damp red litmus paper placed along the inside of the tube.



State the colour of the litmus paper at A and B when the white solid forms.

A
B

(2)

Q2

(Total 6 marks)



3. The alkenes are a **homologous series** of **unsaturated** hydrocarbons.

(a) (i) Tick **two** boxes that are correct statements about members of an homologous series.

They have similar chemical properties

☐

They have the same displayed formula

☐

They have the same general formula

☐

They have the same physical properties

☐

They have the same relative formula masses

☐

(2)

(ii) What is meant by the term **unsaturated**?

.....

.....

(1)

(b) Alkenes react with bromine water. Ethene is the simplest alkene.

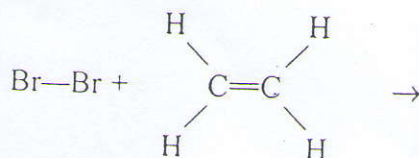
(i) Bromine water is added to ethene. State the starting and finishing colours of the reaction mixture.

Colour at start

Colour at finish

(2)

(ii) Complete the equation by drawing the displayed formula of the product.



(1)



- (c) Isomers are compounds that have the same molecular formula but different displayed formulae.

Draw the displayed formulae of **two** isomers that have the molecular formula C_4H_8 .

(2)

Q3

(Total 8 marks)



4. Iron is extracted from iron ore in a blast furnace.

(a) Label the diagram of the blast furnace. Use only words from the box. Each word may be used once, more than once or not at all.

bauxite

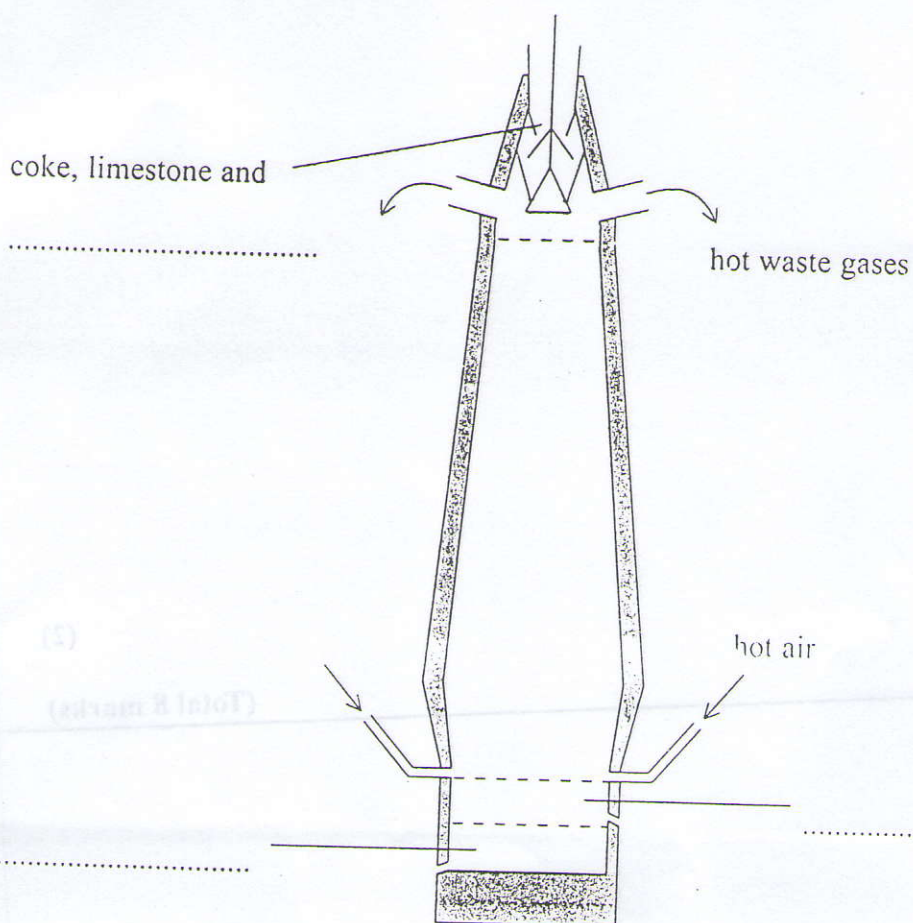
cryolite

haematite

molten iron

sand

slag



(3)

(b) Coke is mainly carbon which burns in the oxygen in the hot air.

(i) Write a chemical equation for the reaction.

(1)

(ii) Why is this reaction important in the blast furnace?

(1)

(c) Limestone is mainly calcium carbonate. In the blast furnace it decomposes to give carbon dioxide and calcium oxide.

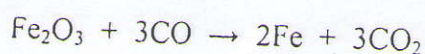
(i) Write a chemical equation for the reaction.

.....
(1)

(ii) Calcium oxide is a base. It removes silicon dioxide impurities. Explain how the calcium oxide removes the silicon dioxide.

.....
.....
.....
(2)

(d) Iron is produced by the reduction of iron(III) oxide. An equation for the reaction is



Why is this reaction described as the reduction of iron(III) oxide?

.....
(1)

(e) Aluminium is another important metal.

(i) Unlike iron, aluminium cannot be extracted from its ore using a blast furnace. Explain why.

.....
(1)

(ii) State **one** large scale use of aluminium. Give a property of aluminium on which this use depends.

Use

Property

(2)

Q4

(Total 12 marks)



5. Sodium is a very reactive metal. It floats on water and reacts rapidly with water.

A small piece of sodium is placed in a trough of water. A reaction takes place and hydrogen gas is given off.

- (a) (i) Give **two** observations, other than the sodium floating, that you could make during the reaction.

1

2

(2)

- (ii) Write a word equation for the reaction.

.....
(1)

- (iii) Universal indicator is added to the water in the trough. State what colour it turns and explain why.

Colour

Explanation

(2)

- (b) A piece of platinum wire is dipped into the solution in the trough and then held in a roaring Bunsen flame. The Bunsen flame becomes coloured.

- (i) What colour does the flame become?

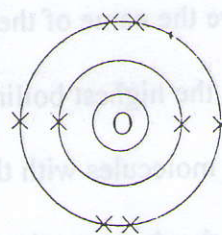
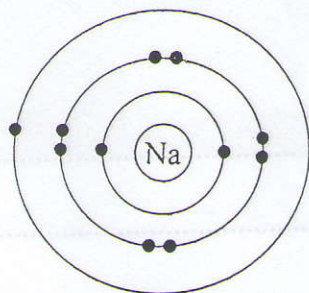
.....
(1)

- (ii) What name is given to this method of identification?

.....
(1)

(c) A piece of sodium is heated in a Bunsen flame. The sodium catches fire and reacts with the oxygen in the air. The product is sodium oxide.

(i) The diagrams show the electron arrangement in an atom of sodium and an atom of oxygen.



Sodium oxide contains ionic bonds. Describe what happens, in terms of electrons, when sodium reacts with oxygen.

.....

.....

.....

.....

.....

.....

(3)

(ii) Draw circles round the symbols that represent the two ions produced.

Na^+

Na^{2+}

Na^-

Na^{2-}

O^{2-}

O_2^-

O^-

O^{2+}

(2)

Q5

(Total 12 marks)

TOTAL FOR SECTION A: 45 MARKS



SECTION B

6. Many useful substances are produced by the fractional distillation of crude oil.
- (a) Bitumen, fuel oil and gasoline are three fractions obtained from crude oil. There are several differences between these fractions.

Give the name of the fraction that has

the highest boiling point range

molecules with the fewest carbon atoms

the darkest colour

(3)

- (b) Some long-chain hydrocarbons are converted into more useful products by a chemical process. Name this process and describe how it is carried out.

.....
.....
.....
.....
.....

(3)

- (c) Some hydrocarbons, such as methane, are used as fuels. When methane undergoes incomplete combustion, carbon monoxide is formed.

- (i) Write a chemical equation for this reaction.

.....

(2)

- (ii) Explain why it is dangerous to breathe air containing carbon monoxide.

.....
.....
.....
.....

(2)

Q6

(Total 10 marks)



7. Three of the elements in Group 7 of the Periodic Table are chlorine, bromine and iodine.

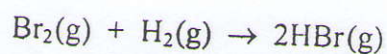
(a) Give the electronic configuration of chlorine.

.....
(1)

(b) How many electrons are there in the outer shell of an atom of iodine?

.....
(1)

(c) Bromine reacts with hydrogen to form hydrogen bromide. The chemical equation for the reaction is



Describe the colour change occurring during the reaction.

Colour change
(2)

(d) Hydrogen bromide and hydrogen chloride have similar chemical properties.

(i) A sample of hydrogen bromide is dissolved in water.

A piece of blue litmus paper is placed in the solution. State, with a reason, the final colour of the litmus paper.

Colour

Reason

.....
(2)

(ii) A sample of hydrogen bromide is dissolved in methylbenzene.

A piece of blue litmus paper is placed in the solution. State, with a reason, the final colour of the litmus paper.

Colour

Reason

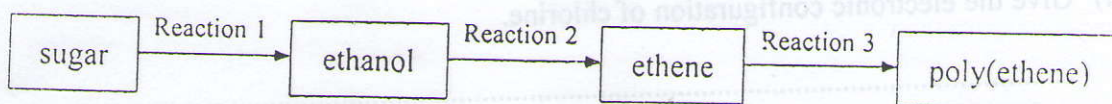
.....
(2)

Q7

(Total 8 marks)



8. Sugar can be converted into poly(ethene) as follows:



(a) (i) State the type of reaction occurring in

Reaction 1

Reaction 2 (2)

(ii) What type of polymerisation occurs in Reaction 3?

..... (1)

(b) State two conditions used in the conversion of sugar to ethanol in Reaction 1.

1

2 (2)

(c) Write a chemical equation for Reaction 2.

..... (2)

(d) Draw the displayed formula of ethanol.

- (e) Many thousands of ethene molecules combine to form a poly(ethene) molecule. Draw that part of the structure of a poly(ethene) molecule that forms from three ethene molecules.

(f) (i) Complete the table for the isotopes of iron.

Atomic number	Mass number	Number of protons	Number of neutrons	Percentage of each isotope in sample
26	56	26	30	8
26	57	26	31	92

(2)

- (f) Nylon is made by a different type of polymerisation. Name this type of polymerisation and describe how it is different from the type of polymerisation used to make poly(ethene).

Type of polymerisation

Description

.....

.....

(2)

Q8

(Total 12 marks)

9. A sample of iron contains two isotopes.

(a) What are isotopes?

.....

.....

.....

(2)

(b) (i) Complete the table for the isotopes of iron.

Atomic number	Mass number	Number of protons	Number of neutrons	Percentage of each isotope in sample
		26	28	8
26	56			92

(3)

(ii) Use information from the table to calculate the relative atomic mass of the sample of iron. Give your answer to one decimal place.

.....

.....

.....

.....

(2)

(c) Why do the two isotopes of iron have the same chemical properties?

.....

.....

(1)

(d) Iron is a transition metal. State **two** properties of iron that are typical of transition metals, but not of other metals.

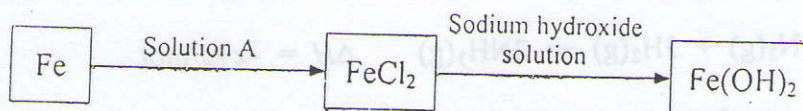
1

2

(2)



(e) Two reactions involving iron and its compounds are shown in this sequence:

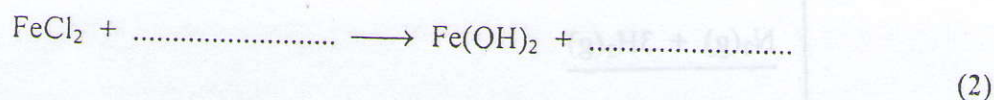


(i) Give the name of

solution A

Fe(OH)_2 (2)

(ii) Complete the chemical equation for the conversion of FeCl_2 to Fe(OH)_2 .



(iii) If Fe(OH)_2 is left in air for some time, a reaction occurs and there is a colour change. What type of reaction occurs and what colour change is seen?

Type of reaction

Colour change (3)

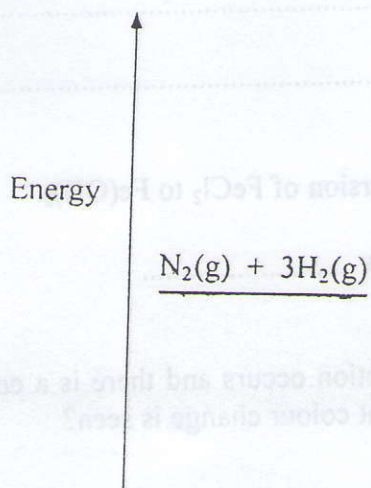
(Total 17 marks)

10. The reaction used to manufacture ammonia is



(a) This reaction can be represented by an energy level diagram.

Complete the diagram by showing the products of the reaction.



(1)

(b) The table shows the values of some average bond dissociation energies.

Bond	$\text{N} \equiv \text{N}$	$\text{H}-\text{H}$	$\text{N}-\text{H}$
Dissociation energy (kJ/mol)	944	436	388

Use the values in the table to calculate the energy change occurring during the reaction to manufacture ammonia.

.....

.....

.....

.....

.....

(3)



- (c) To obtain a reasonable yield of ammonia the reaction is carried out at a temperature of 450°C and a pressure of 250 atmospheres.
Predict what will happen to the yield of ammonia in the equilibrium mixture if the conditions are changed as follows.

Temperature is increased

Pressure is decreased

(2)

- (d) The temperature of a mixture of nitrogen, hydrogen and ammonia gases is decreased until all the gases have liquefied.

- (i) Describe **two** changes in the movement of gas molecules as a gas liquefies.

1

.....

2

.....

(2)

(ii)

Molecule	N_2	H_2	NH_3
Heat of vaporisation (kJ/mol)	2.8	0.45	23

Use the values in the table to predict which of the three gases will be the last to liquefy.

.....

(1)

- (e) Draw a dot and cross diagram to show the arrangement of **outer** electrons in a molecule of nitrogen.

(2)

Q10

(Total 11 marks)



11. (a) A solution was made by dissolving 1.62 g of hydrogen bromide, HBr, in 250 cm³ of water.

(i) Calculate the relative formula mass of hydrogen bromide. Use data from the Periodic Table on page 2.

.....

 (1)

(ii) Calculate the amount, in moles, of hydrogen bromide in a 1.62 g sample.

.....

 (2)

(iii) Calculate the concentration, in mol dm⁻³, of the hydrogen bromide solution.

.....

 (2)

(iv) Calculate the concentration, in g dm⁻³, of the hydrogen bromide solution.

.....

 (2)



- (b) Hydrogen bromide solution can be neutralised by adding sodium hydroxide solution.

A 20.0 cm^3 sample of a solution of hydrogen bromide had a concentration of $0.200 \text{ mol dm}^{-3}$.

- (i) Write a chemical equation for this neutralisation reaction.

.....
(1)

- (ii) Explain, with reference to protons, why this reaction is described as a neutralisation reaction.

.....
.....
(2)

- (iii) Calculate the amount, in moles, of hydrogen bromide in 20.0 cm^3 of $0.200 \text{ mol dm}^{-3}$ solution.

.....
.....
(2)

- (iv) Calculate the volume of $0.100 \text{ mol dm}^{-3}$ sodium hydroxide solution needed to neutralise this sample of hydrogen bromide solution.

.....
.....
(2)

- (v) Suggest the name of *an indicator* (other than litmus), and its colour change, that could be used to ~~check when~~ neutralisation was complete.

Name of indicator

Colour change

(3)

Q11

(Total 17 marks)

TOTAL FOR SECTION B: 75 MARKS

TOTAL FOR PAPER: 120 MARKS

END



the end

END

TOTAL FOR PAPER: 120 MARKS

TOTAL FOR SECTION B: 75 MARKS

(Total 17 pages)

(97/01)

